

BIRCH, STEWART, KOLASCH & BIRCH, LLP

TERRELL C. BIRCH
RAYMOND C. STEWART
JOSEPH A. KOLASCH
JAMES M. SLATTERY
BERNARD L. SWEENEY*
MICHAEL K. MUTTER
CHARLES GORENSTEIN
GERALD M. MURPHY, JR.
LEONARD R. SVENSSON
TERRY L. CLARK
ANDREW D. MEIKLE
MARC S. WEINER
JOE MCKINNEY MUNCY
ROBERT J. KENNEY
DONALD J. DALEY
JOHN W. BAILEY
JOHN A. CASTELLANO, III
GARY D. YACURA

OF COUNSEL
HERBERT M. BIRCH (1905-1996)
ELLIOT A. GOLDBERG*
WILLIAM L. GATES*
EDWARD H. VALANCE
RUPERT J. BRADY (RET)*
F. PRINCE BUTLER
FRED S. WHISENHUNT

*ADMITTED TO A BAR OTHER THAN VA

INTELLECTUAL PROPERTY LAW
8110 GATEHOUSE ROAD
SUITE 500 EAST
FALLS CHURCH, VA 22042-1210
USA

(703) 205-8000

FAX: (703) 205-8050
(703) 698-8590 (G IV)

e-mail: mailroom@bskb.com
web: http://www.bskb.com

CALIFORNIA OFFICE
COSTA MESA, CALIFORNIA

THOMAS S. AUCHTERLONIE
JAMES T. ELLER, JR.
SCOTT L. LOWE
MARK J. NUEL, PH.D.
D. RICHARD ANDERSON
PAUL C. LEWIS
MARK W. MILSTEAD*
JOHN CAMPA*
RICHARD J. GALLAGHER

REG. PATENT AGENTS
FREDERICK R. HANDREN
MARYANNE ARMSTRONG, PH.D.
MAKI HATSUMI
MIKE S. RYU
CRAIG A. McROBBIE
GARTH M. DAHLEN, PH.D.
LAURA C. LUTZ
ROBERT E. GOOZNER, PH.D.
HYUNG N. SOHN
MATTHEW J. LATTIG
ALAN PEDERSEN-GILES
JUSTIN D. KARJALA
C. KEITH MONTGOMERY
TIMOTHY R. WYCKOFF
HERMES M. SOYEZ, PH.D.
KRISTI L. RUPERT, PH.D.

Date: August 11, 2000
Docket No.: 2950-0167P

Assistant Commissioner for Patents
Box PATENT APPLICATION
Washington, D.C. 20231

Sir:

Transmitted herewith for filing is the patent application of

Inventor(s): KIM, Byung J.
YOO, Jea Y.; KANG, Ki W.
SEO, Kang S.

For: METHOD FOR CREATING AND RECORDING TRANSPORT TIME
INFORMATION FOR DATA RECORDED ON A DISK RECORDING MEDIUM

Enclosed are:

- ☒ A specification consisting of 20 pages
- ☒ 12 sheet(s) of formal drawings
- ☐ An assignment of the invention
- ☒ Certified copy of Priority Document(s)
- ☒ Executed Declaration ☐ Original ☒ Photocopy
- ☐ A verified statement to establish small entity status under 37 CFR 1.9 and 37 CFR 1.27
- ☐ Preliminary Amendment
- ☐ Information Disclosure Statement, PTO-1449 and reference(s)

Other

The filing fee has been calculated as shown below:

LARGE ENTITY				SMALL ENTITY	
FOR	NO. FILED	NO. EXTRA	RATE FEE		RATE FEE
BASIC FEE	***** ***** *****	***** ***** *****	***** ***** \$690.00 *****	or	**** **** \$345.00 ****
TOTAL CLAIMS	21 - 20 =	1	x18 =\$ 18.00	or	x 9 = \$ 0.00
INDEPENDENT	10 - 3 =	7	x78 =\$ 546.00	or	x 39 = \$ 0.00
MULTIPLE DEPENDENT CLAIM PRESENTED <u>no</u>			+260 = \$ 0.00	or	+130 = \$ 0.00
			TOTAL \$1,254.00		TOTAL \$ 0.00

X A check in the amount of \$1,254.00 to cover the filing fee and recording fee (if applicable) is enclosed.

 Please charge Deposit Account No. 02-2448 in the amount of \$. A triplicate copy of this transmittal form is enclosed.

 No fee is enclosed.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. 1.16 or under 37 C.F.R. 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By 

TERRY L. CLARK
Reg. No. 32,644
P. O. Box 747

Falls Church, Virginia 22040-0747

(703) 205-8000
TLC/amr

007780-2085E950

**METHOD FOR CREATING AND RECORDING TRANSPORT TIME
INFORMATION FOR DATA RECORDED ON A DISK**

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 The present invention relates to a method for
creating and recording transport time information to be
used as time references on when to transmit data transport
packets recorded in the format of a transport stream in a
disk recording medium such as a high-density digital
10 versatile disk (HDVD) to a connected equipment such as a
digital television, and a method for transmitting data
transport packets on time indicated by the recorded
transport time information while reproducing recorded data
stream.

15 **2. Description of the Related Art**

FIG. 1 is a block diagram of a DVD player and a
general television which are connected each other. The DVD
player 100, which reproduces video and audio data recorded
in a disk recording medium such as a DVD-ROM, comprises an
20 optical pickup 12 for detecting signals recorded in a disk

11 such as a DVD-ROM; an analog signal processor 13 for
converting the detected high-frequency signals into binary
signals; a digital signal processor 14 for processing the
binary signals into a program stream (PS) of MPEG
5 standard; a decoder 15 for decoding the data contained in
the PS into non-compressed video and audio data and
converting them into corresponding analog signals to be
applied to the general television 600; a microcomputer 16
controlling operations of the above elements for data
10 reproduction; and a memory 17 for temporally storing data
produced while reproduction.

The DVD player 100 configured as FIG. 1 decodes and
converts data in the PS reproduced from the disk 11 such as
a DVD-ROM into analog video and audio signals, and then
15 applies them to the conventional television 600 for video
and audio presentation.

FIG. 2 shows a hierarchical structure of a recorded
data stream and time information, especially the
presentation timestamp (PTS) and decoding timestamp (DTS),
20 recorded in a read-only disk such as a DVD-ROM.

As shown in FIG. 2, one or more video objects (VOBs)
are recorded in a read-only DVD during disk manufacturing.
A single VOB is corresponding to a single title or program
and is composed of many video object units (VOBUs). A
25 single VOB is composed of a navigation pack and several
data packs. Each data pack consists of a pack header and
several program elementary stream packets (PESPs) which
contains respective a PES header in which the PTS and DTS
information are written.

30 The audio/video data stream retrieved from the PESPs
is decoded on time indicated by the DTS information and
then temporarily stored in a memory or a buffer, and
outputted to a speaker and a screen of the general

television 600 on time indicated by the PTS information.

That is, the point of time when to convert the audio and video data stream reproduced from a read-only DVD is determined based on the DTS and PTS written in the PES header of each PES, so that the converted analog real audio and video signals can be presented to a viewer through a speaker and a screen of a general television without any discontinuity.

FIG. 3 shows an example of several electric home appliances connected each other through a digital interface such as the IEEE 1394 standard. The electric home appliances connected each other are a digital television (TV) 500; a set top box (STB) 200 for receiving RF broadcast signals, extracting a data stream belonging to a selected program from the broadcast signals, and transmitting the extracted stream to the digital TV 500; and a streamer 300 recording or reproducing a digital data stream to/from a rewritable digital versatile disk (DVD-RAM).

The streamer 300 comprises a stream recording unit 32 for recording transport packets, which constitutes a transport stream (TS) for a digital broadcast program, transmitted from the STB 200 connected through the IEEE 1394 standard in a rewritable DVD 31; a stream reproducing unit 33 for reproducing the TS recorded in the rewritable DVD 31; an interface unit 34 for transmitting the reproduced TS to the STB 200 and receiving a data stream from the STB 200 through the IEEE 1394 standard; a controller 35 for controlling the operations of the above elements; and a memory 35 storing data necessary for the control operation of the controller 35.

The streamer 300 configured as above records a digital data stream of broadcast programs received from the

STB 200 in a rewritable DVD in a pre-specified format, or divides a data stream reproduced from the rewritable DVD into transport packets and then transmits them to the STB 200 through the IEEE 1394 standard.

5 The STB 200 transmits the received transport packets to the digital TV 500, then the digital TV 500 decodes the transport packets to present high-quality video and audio. Such operations make it possible to record digital broadcast programs and reproduce them.

10 FIG. 4 is a pictorial representation showing a hierarchical structure of a data stream recorded in the rewritable DVD and packet arrival time (PAT) information recorded in each transport packet (TP).

As shown in FIG. 4, one or more stream objects (SOBs) 15 are recorded in a rewritable DVD. A single SOB is composed of many stream object units (SOBUs). Partial stream belonging to a single SOBU is written across several fixed-size sectors. Header information and several TPs are written in each sector.

20 The streamer 300 adds 4-byte PAT to each TP as shown in FIG. 4 when recording the received data stream. The 4-byte PAT consists of a 9-bit arrival timestamp (ATS) extension marked as 'ATS_ext' and a 39-bit arrival timestamp base marked as 'ATS_base' according to the MPEG 25 standard. The arrival time extension is a modulo-300 counter that is incremented at a rate of 27 MHz, whereas the arrival time base is incremented at a rate of 90 KHz.

The reason of recording the PAT in each packet as explained above is to transmit recorded packets at same 30 interval which transport packets are received at, and to use the recorded PAT as a position index when searching for the video data, especially the infra-coded picture data recorded in the rewritable DVD. The reason why the position

written in every transport packet for a HDVD-ROM, the space for program data may be remarkably decreased.

Accordingly, a method for recording time information to use as a packet sending time reference without decreasing program recording area should be developed urgently.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a method for creating and recording transport time information of data recorded in high-density disk recording medium, which uses a program clock reference (PCR) inserted intermittently in transport packets as a transport time reference of a packet, or creates transport time reference information for a transport packet every data recording unit accommodating several transport packets, writes the created transport time reference information in the corresponding data recording unit, and uses the written information as a time reference for transmitting the transport packet belonging to a corresponding data recording unit.

The method for creating and recording transport time reference information for a disk recording medium according to the present invention records transport time reference information for an arbitrary transport packet in a recording unit such as a pack in the header of the pack or in the header of the arbitrary packet while grouping several transport packets into a pack when recording a program in the form of a transport packet, and, when reproducing a recorded program, detects a transport time reference based on the information recorded in the header of a pack or an arbitrary transport packet, and then

transmits the arbitrary transport packet at the detected time reference.

Also, the method for creating and recording transport time reference information for a high-density disk recording medium according to the present invention specifies a fixed-positioned, for example the first transport packet to include time information for a transport time reference, and records the transport time reference information in the header of the fixed-positioned transport packet or a pack, and, when reproducing recorded transport packets, transmits the fixed-positioned transport packet at time interval according the time information for that packet.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention, illustrate the preferred embodiments of the invention, and together with the description, serve to explain the principles of the present invention.

In the drawings:

FIG. 1 is a block diagram of a digital versatile disk player and a general television which are connected each other;

FIG. 2 shows a hierarchical structure of a recorded data stream and time information, especially the presentation timestamp and decoding timestamp, recorded in a read-only disk such as a DVD-ROM.

FIG. 3 shows an example of several electric home appliances connected each other through a digital interface such as the IEEE 1394 standard;

FIG. 4 is a pictorial representation showing a

hierarchical structure of a data stream recorded in the rewritable DVD and packet arrival time information recorded in each transport packet;

FIG. 5 is a block diagram of a high-density DVD player and a digital television to which a method for creating and recording transport time reference information according to the present invention is applied;

FIG. 6 shows a hierarchical data structure and a recording example of transport time reference information for a data stream recorded in a HDVD-ROM according to the present invention;

FIG. 7 shows the recording position of a program clock reference (PCR) which is intermittently recorded in transport packets;

FIG. 8 is an example of transport time reference information recorded according to the present invention;

FIGS. 9 and 10 show another embodiment for creating and recording transport time reference information according to the present invention;

FIG. 11 is another embodiment for creating and recording transport time reference information according to the present invention; and

FIG. 12 is another embodiment for creating and recording transport time reference information according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In order that the invention may be fully understood, preferred embodiments thereof will now be described with reference to the accompanying drawings.

FIG. 5 is a block diagram of a HDVD player 400 and a digital television 500 which are connected each other. The

HDVD player 400, which reproduces video and audio data recorded in a HDVD-ROM 41, comprises an optical pickup 42 for detecting signals recorded in the ROM disk 41; an analog signal processor 43 for converting the detected
 5 high-frequency signals into binary signals; a digital signal processor 44 for processing the binary signals to restore them into a digital data stream; a TS MUX 45 for extracting transport packets from the restored data stream; and a controller 46 for controlling the data reproduction
 10 and data processing timing of each element.

The HDVD player 400 configured as FIG. 5 reproduces recorded data from the HDVD-ROM 41, extracts transport packets from reproduced data, and transmits the extracted transport packets to the digital TV 500 on time specified
 15 for each packet. The digital TV 500 decodes the received packets to present them to a viewer immediately after receiving them.

The data stream recorded in the HDVD-ROM 41 has a hierarchical data structure as shown in FIG. 6, and it has
 20 transport time reference information, of which format is also shown in FIG. 6, for transmitting transport packets to the digital television 500 at time reference difference interval which should be satisfied for continuous data presentation.

25 The hierarchical structure and the data syntax of FIG. 6 is explained in detail.

As shown in FIG. 6, one or more high-density video objects (HOBs) are recorded in a HDVD-ROM in a format of transport stream during manufacturing the ROM disk. A
 30 single HOB is corresponding to a single title or program and is composed of many high-density object units (HOBUs). A single HOB is composed of several packs marked as 'HD_PCK' and always contains at least a GOP unit, which

always has infra-coded picture at its head part, of the MPEG standard. Each pack consists of a pack header, which contains management information for transport packets written in that pack, and several transport packets.

5 The management information recorded in the pack header includes the transport time reference information for recorded packets, and the transport time reference information is same with the PCR in both of format and function. The PCR is specified in the digital broadcast
10 standard to be inserted in transport packets more than once during a few milliseconds in order that a data presenting machine such as a digital TV may adjust a local clock, which is used as a time reference on when to present received packets, synchronously with a program source clock
15 of a broadcast station broadcasting TP-formatted programs. Accordingly, same as the PCR, the transport time reference information is written in transport packets every a few milliseconds which is specified in a digital broadcast standard when a program(or a title)-containing HDVD-ROM is
20 manufactured.

 The format of the transport time reference information to be recorded in the pack header consists of a 9-bit extension time 'SYS_PCR_ext' and a 39-bit base time 'SYS_PCR_base' according to the MPEG standard. The
25 extension time 'SYS_PCR_ext' is a modulo-300 counter that is incremented at a rate of 27 MHz, whereas the base time 'SYS_PCR_base' is incremented at a rate of 90 KHz.

 Whereas, the recording position to write PCR which can be used as a transport time reference is the optional
30 field shown in FIG. 7. The optional field is optionally contained in the header of a transport packet.

 FIG. 8 is an example of transport time reference information recorded according to the present invention. If

divided time between the PCR-contained packets.

Accordingly, the HDVD player 400 can transmit recorded transport packets on time without parsing reproduced data to the level of a transport packet, that is, without decoding the contents of a transport packet.

The digital TV 500 compensates its own clock speed based on every the PCR difference value between two PCR-contained transport packets, and presents audio and video signals after determining the presentation time of the received transport packets based on the compensated self clock, thereby conducting video and audio presentation with no discontinuities.

If there is no transport packet to record PCR in a certain pack, the time reference to send the first transport packet TP1 of the pack is recorded in the transport time reference information fields 'SYS_PCR_base' and 'SYS_PCR_ext' instead of a PCR, and the value of 0000b is recorded in the packet location field 'PCR_PKT_POS' of the pack. Accordingly, the HDVD player 400 can obtain transport time references more often compared with the PCR-only recording embodiment when reproducing such-recorded HDVD-ROM, thereby adjusting the transport time interval between transport packets more accurately.

FIGS. 9 and 10 show another embodiment for creating and recording transport time reference information according to the present invention, which records the location information only for PCR-containing transport packets in the packet location field 'PCR_PKT_POS'. Where a PCR is recorded in the first transport packet TP1 of the first pack HD_PCK #1 and in the third transport packet TP3 of the second unit pack HD_PCK #2, the value 0001b for the first location is recorded in the packet location field of the first pack header, and the value 0011b for the third

location is recorded in the applicable field of the second pack header.

Accordingly, when the HDVD player 400 reproduces such-recorded HDVD-ROM, the controller 46 searches for the PCR-contained transport packet indicated by the packet location field 'PCR_PKT_POS' of the pack header, reads out the PCR contained in the found packet, and uses the read PCR as a transport time reference for transmitting the found packet. In this embodiment, the controller 46 refers to the information of the TP header by decoding to the transport packet level.

FIG. 11 is another embodiment for creating and recording transport time reference information according to the present invention, which records the transport time reference information for the first transport packet of each pack. In this embodiment, it is not necessary to record the location information for a transport packet to be transmitted based on the recorded transport time reference information in the pack header since all transport packets related with the transport time reference information of the pack headers are fixed as the first.

If a PCR is recorded in the first transport packet, the value of the PCR is copied to and used as a transport time reference, whereas if a PCR is recorded in the third transport packet of the second pack as shown in FIG. 11, the time value of the PCR of third packet is ignored and the value for time reference to be used for the first packet is recorded in the fields of time base 'SYS_PCR_base' and time offset 'SYS_PCR_ext' as the transport time reference information.

Accordingly, when reproduction is proceeding, the controller 46 detects the transport time reference information written in fields 'SYS_PCR_base' and

'SYS_PCR_ext' of the pack header and transmits the first transport packet to the digital television 500 through applying the first packet to the TS MUX 45 at the time specified by the detected transport time reference

5 information. For the other packets except the first one, the time differences between transport time references recorded for two first packets of consecutive packs are equally divided, then each packet except the first one is transmitted at each divided point of time.

10 Instead of the first packet, it is possible to designate a packet in other position, for example the last one as a reference packet corresponding to transport time reference information recorded in the pack header.

FIG. 12 is another embodiment for creating and
15 recording transport time reference information according to the present invention. In this embodiment, no information on the transport time reference and the packet location for a time-information-contained packet is recorded in the pack header.

20 Instead, a PCR is always recorded in the first transport packet of every pack when a program-recorded HDVD-ROM is manufactured. When such-manufactured HDVD-ROM is reproduced in the HDVD player 400, the controller 46 checks the header information of the first transport packet
25 of every pack, reads out a recorded PCR, and transmits the first packet on time specified by the read PCR.

The method for creating and recording transport time reference information for a high-density disk recording medium according to the present invention can record the
30 transport time reference information without decreasing recording efficiency too much, or use the PCR, which should be recorded in transport packets intermittently, as transport time reference information without recording

additional data for transport time reference, thereby delivering digital data recorded in a disk to an external device such as a digital TV without deviation of transmitting-time interval between transport packets.

5 Although the preferred embodiment of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the
10 invention as recited in the accompanying claims.

What is claimed is:

1. A data recording method for a disk recording medium, comprising the steps of:

15 (a) inserting time information for transport time reference in transport packets at arbitrary intervals and recording the transport packets in the disk recording medium, wherein the intervals are shorter than a time interval specified in a digital broadcast standard;

20 (b) identifying a transport packet in which the time information is inserted and detecting the recording position of the identified transport packet; and

 (c) writing the detected recording position in the header of a pack which is composed of several recorded transport packets.

25 2. The method set forth in claim 1, wherein said step (c) further writes the time information inserted in the identified transport packet in the header of a pack.

 3. The method set forth in claim 1, wherein the time information for transport time reference is equal to a
30 program clock reference which should be contained intermittently in a data stream of broadcast program.

 4. A method for reading and transmitting data

recorded in a disk recording medium, comprising the steps of:

(a) reproducing a predetermined-sized pack recorded in the disk recording medium;

5 (b) reading information on a recording position recorded in a header of the reproduced pack;

(c) reading time information for transport time reference recorded in a packet header of a transport packet located in a position indicated by the read position
10 information; and

(d) transmitting the transport packet located in the position indicated by the read position information on time specified by the read time information.

5. The method set forth in claim 4, wherein the time
15 information for transport time reference is equal to a program clock reference which should be contained intermittently in a data stream of broadcast program.

6. A method for reading and transmitting data recorded in a disk recording medium, comprising the steps
20 of:

(a) reproducing a predetermined-sized pack recorded in the disk recording medium;

(b) reading recording position information and time information for transport time reference recorded in a
25 header of the reproduced pack; and

(c) transmitting the transport packet located in a position indicated by the read position information on time specified by the read time information.

7. A data recording method for a disk recording
30 medium, comprising the steps of:

(a) recording transport packets in the disk recording medium while grouping several transport packets into a pack; and

(b) writing time information for transport time reference for a transport packet, which is in a pre-specified position in the pack, in a header of the transport packet.

5 8. The method set forth in claim 7, wherein the time information for transport time reference is equal to a program clock reference which should be contained intermittently in a data stream of broadcast program.

10 9. The method set forth in claim 7, wherein the pre-specified position is the first.

10 10. A data recording method for a disk recording medium, comprising the steps of:

15 (a) recording transport packets in the disk recording medium while grouping several transport packets into a pack; and

 (b) writing time information for transport time reference for a transport packet, which is in a pre-specified position in the pack, in a header of the pack.

20 11. The method set forth in claim 10, wherein said step (b) writes a program clock reference as the time information for transport time reference, if the transport packet at the pre-specified position contains the program clock reference which is specified to be included intermittently in a data stream by the digital broadcast
25 standard.

 12. The method set forth in claim 10, wherein the pre-specified position is the first.

30 13. A method for reading and transmitting data recorded in a disk recording medium, comprising the steps of:

 (a) reproducing a predetermined-sized pack recorded in the disk recording medium;

 (b) reading time information for transport time

reference recorded in a header of a transport packet which is in pre-specified position; and

(c) transmitting the transport packet located at the pre-specified position on time specified by the read time
5 information.

14. The method set forth in claim 13, wherein the time information for transport time reference is equal to a program clock reference which should be contained intermittently in a data stream of broadcast program.

10 15. The method set forth in claim 13, wherein the pre-specified position is the first.

16. A method for reading and transmitting data recorded in a high-density disk recording medium, comprising the steps of:

15 (a) reproducing a predetermined-sized pack recorded in the disk recording medium; and

(b) transmitting a transport packet located at a pre-specified position in the reproduced pack based on time indicated by time information recorded in a header of the
20 reproduced pack.

17. The method set forth in claim 16, wherein the pre-specified position is the first.

18. A disk stroage device containing data of a program recorded in a plurality of predetermined-sized
25 packs, information on a recording position in a pack of a transport packet having time information for transport time reference being recorded in a header of the pack, wherein the program data are composed of predetermined-sized transport packets.

30 19. The device set forth in claim 18, wherein the time information for transport time reference recorded in the transport packet is further recorded in the header of the pack.

20. A disk stroage device containing data of a
program recorded in a plurality of predetermined-sized
packs, transport time reference information for a transport
packet located at a pre-specified position in a pack being
5 recorded in a header of the pack, wherein the program data
are composed of predetermined-sized transport packets.

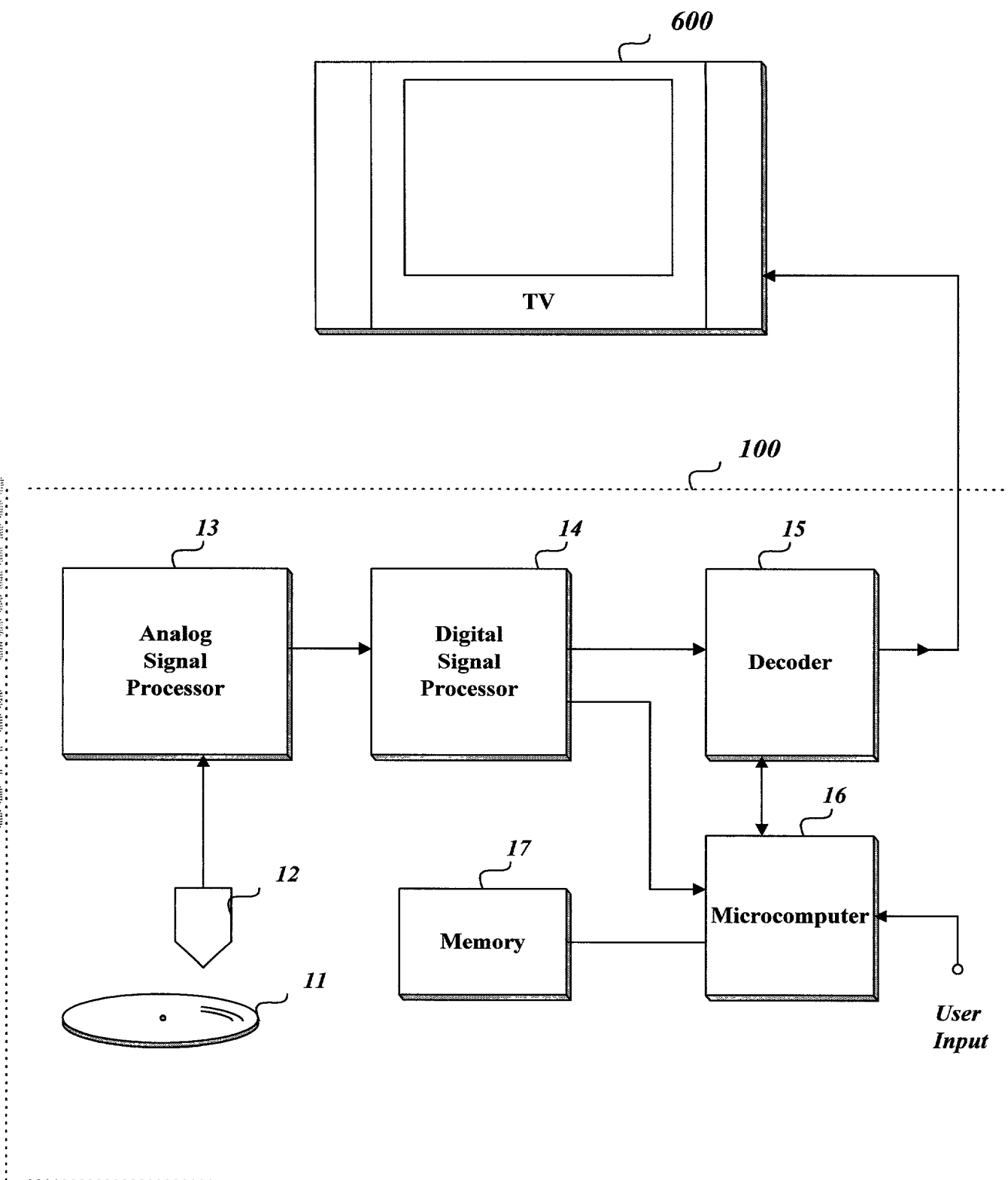
21. A disk stroage device containing data of a
program recorded in a plurality of predetermined-sized
packs, transport time reference information for a transport
10 packet located at a pre-specified position in a pack being
recorded in a header of the transport packet, wherein the
program data are composed of predetermined-sized transport
packets.

ABSTRACT OF DISCLOSURE

The present invention relates to a method for creating and recording transport time reference information used to transmit data transport packets recorded as
5 transport stream format in a disk recording medium such as the high-density DVD to a connected digital television, and a method for transmitting data transport packets on time indicated by the recorded transport time reference information while reproducing recorded data stream. This
10 method records both of transport time reference information for an arbitrary transport packet in a recording unit such as a pack in the header of the pack or the arbitrary packet and location information for the arbitrary packet while grouping several transport packets into a pack when
15 recording a program in the form of a transport packet, and, when reproducing a recorded program, detects the transport time reference based on the information recorded in the header of a pack or the arbitrary transport packet, and then transmits the arbitrary transport packet at the
20 detected time reference. The other method specifies a fixed-positioned, for example the first transport packet to include time information for transport time reference, and records the transport time reference information in the header of the fixed-positioned transport packet or a pack,
25 and, when reproducing recorded transport packets, transmits the fixed-positioned transport packet at time specified by the time information for that packet. Therefore, despite not recording transport time reference information for all transport packets, this invention can deliver digital data
30 recorded in a disk, in which the positions of infra-coded pictures are fixed to provide quick trick play, to a digital TV without deviation of transmitting-time interval between transport packets.

FIG. 1

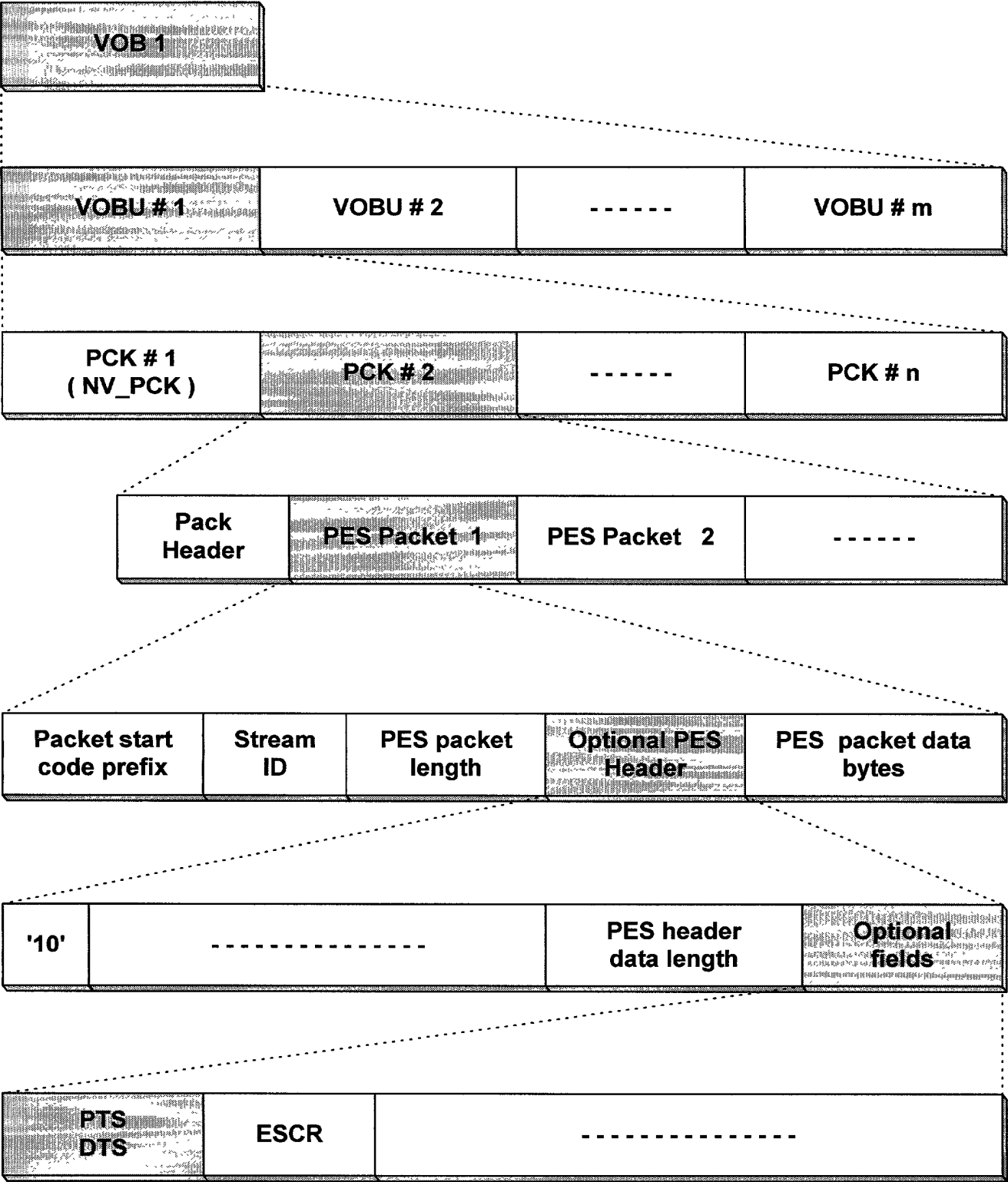
FIG. 1



Conventional Art

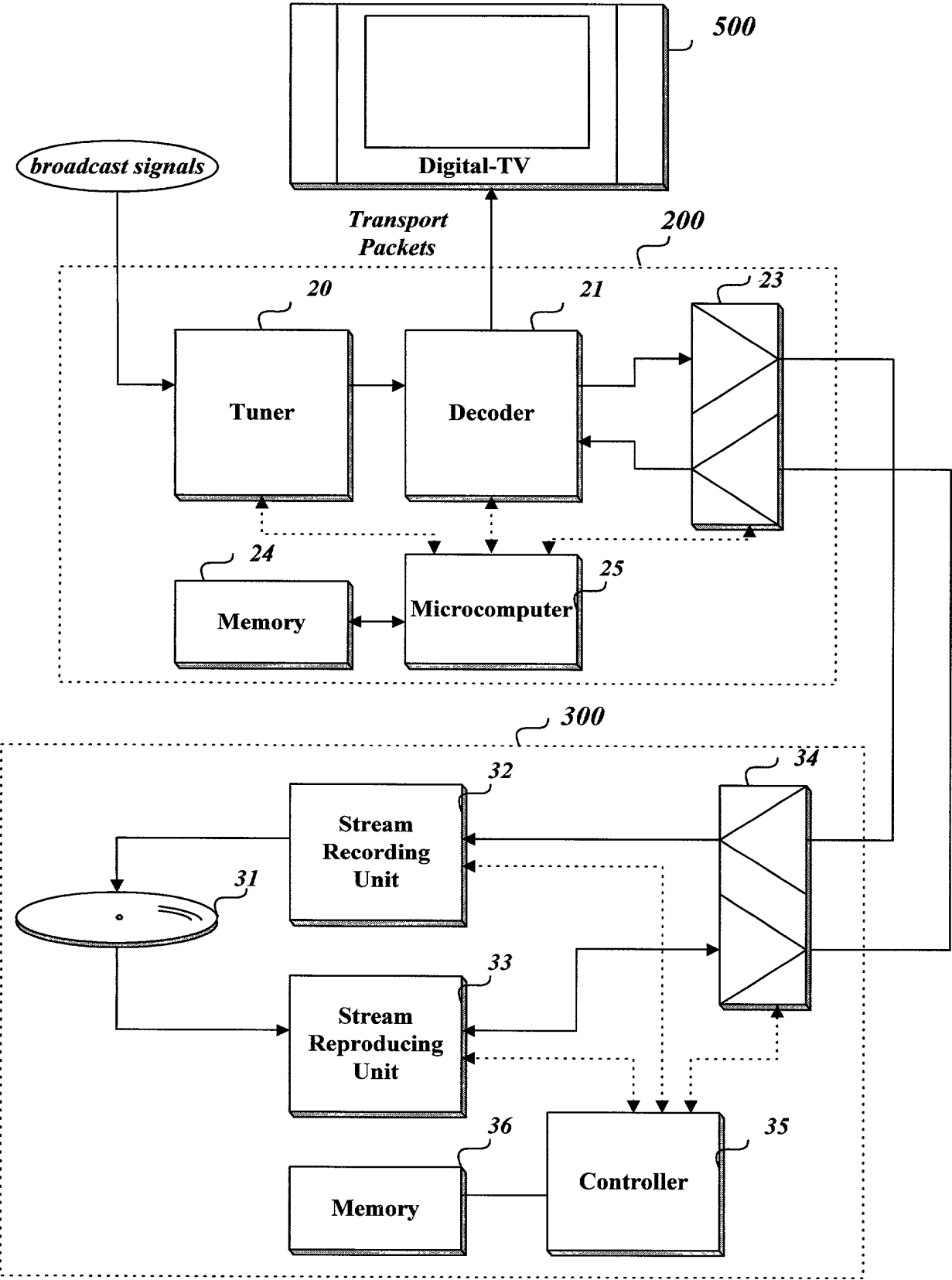
FIG. 2

FIG. 2



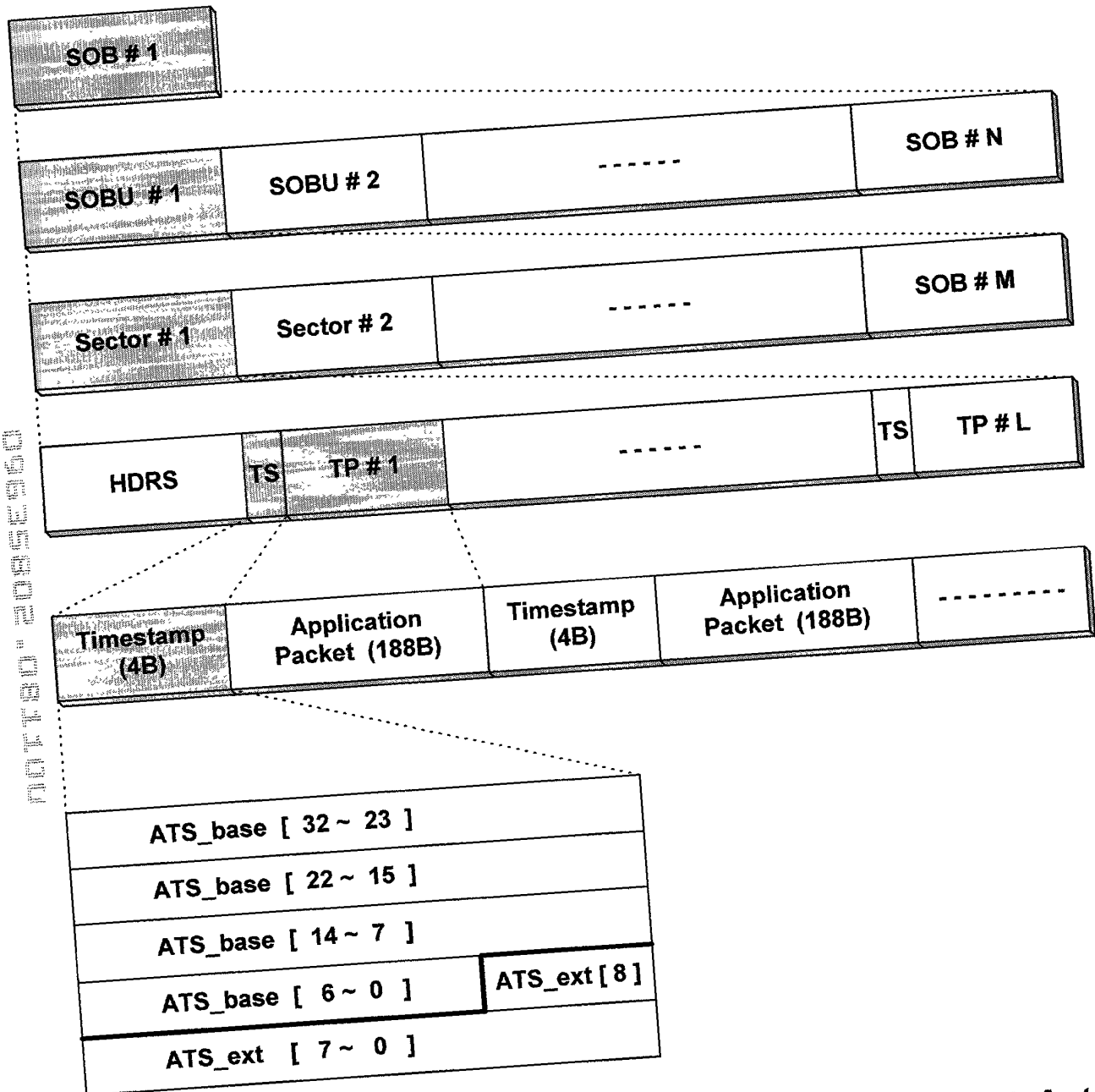
Conventional Art

FIG. 3



Conventional Art

FIG. 4



Conventional Art

FIG. 5

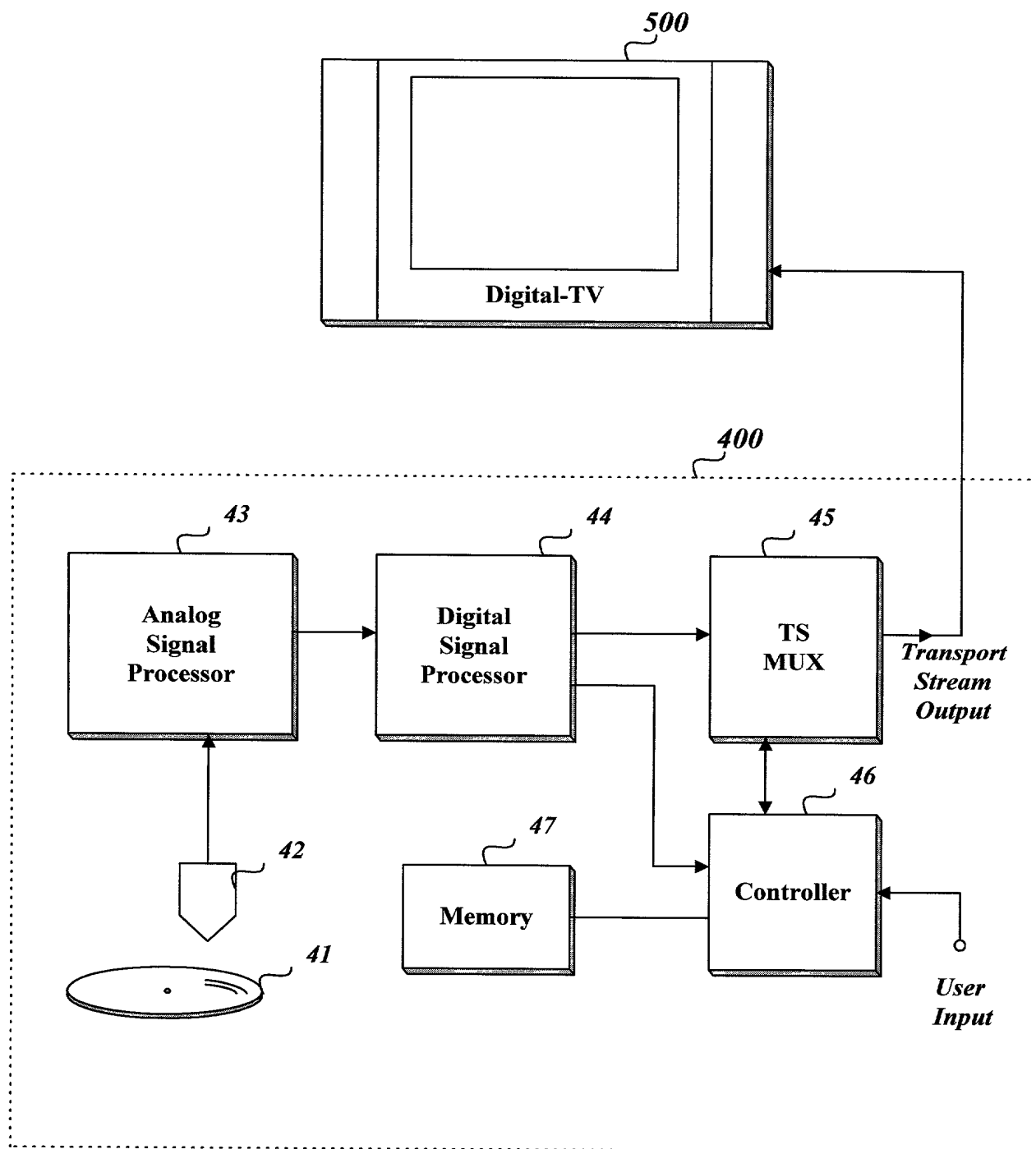
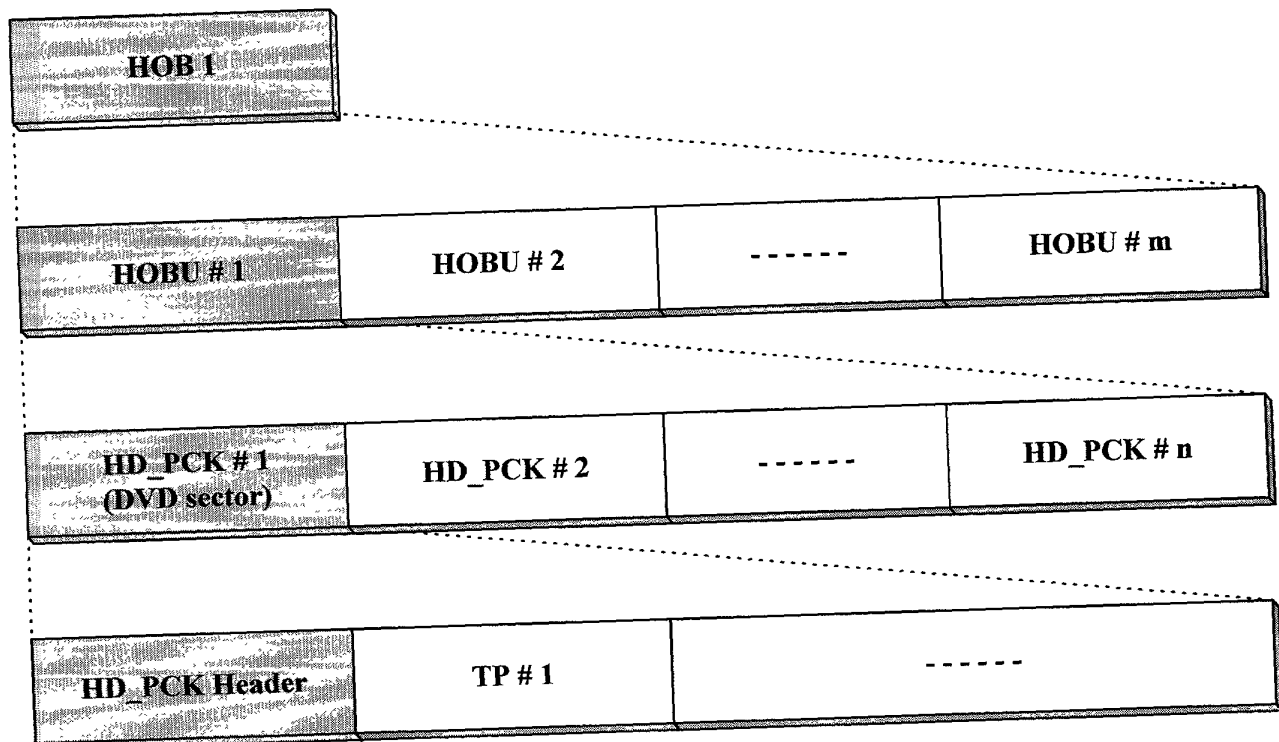


FIG. 6

FIG. 6



Field	bits
PCR_PKT_POS	4
RSV	2
SYS_PCR_base	33
SYS_PCR_ext	9
TRICK_S_POS	4
TRICK_E_POS	4
F_PKT_offset	8
Valid_PKT_Nu	8

SYS_PCR_base [32 ~ 23]	
SYS_PCR_base [22 ~ 15]	
SYS_PCR_base [14 ~ 7]	
SYS_PCR_base [6 ~ 0]	SYS_PCR_ext [8]
SYS_PCR_ext [7 ~ 0]	

FIG. 7

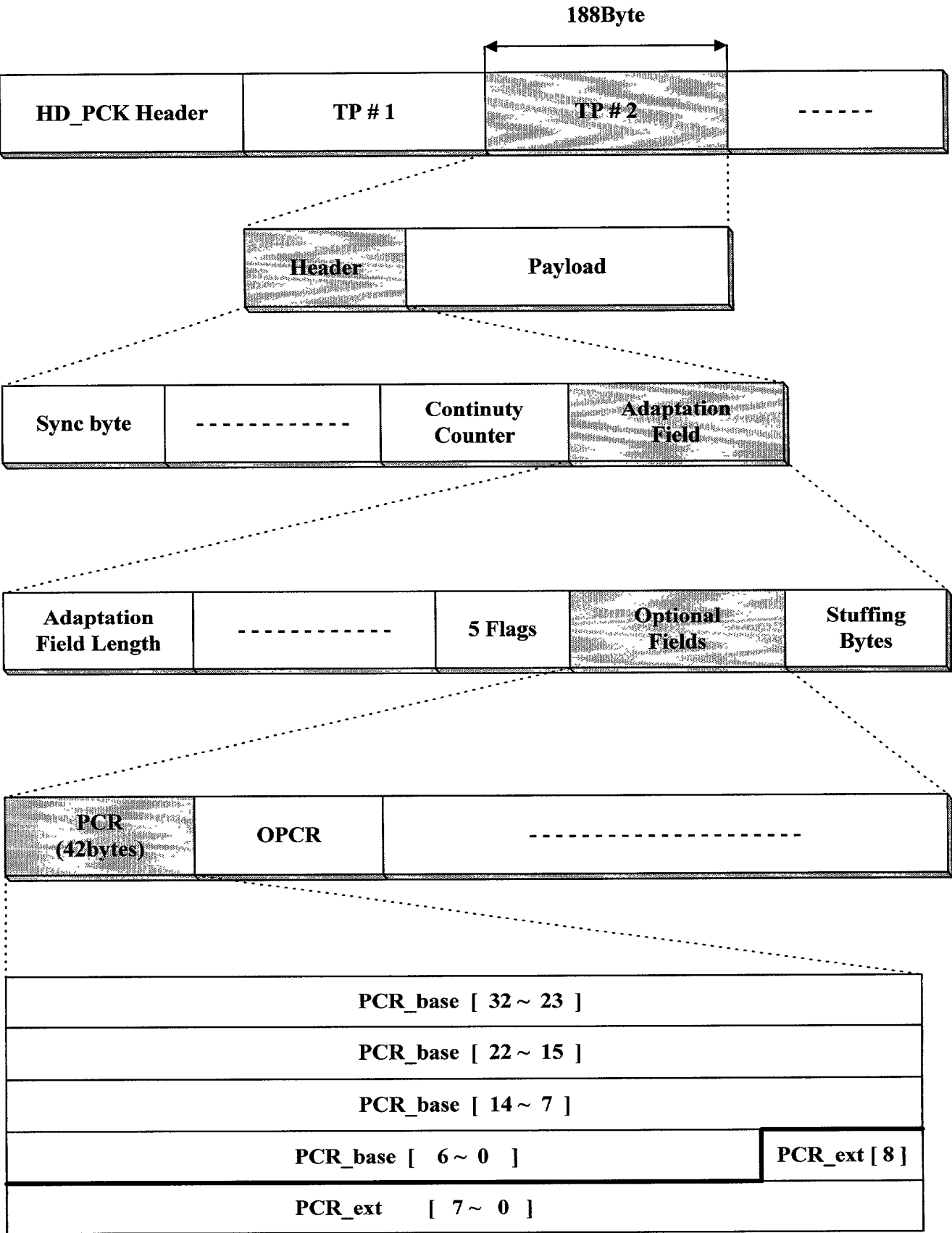


FIG. 8

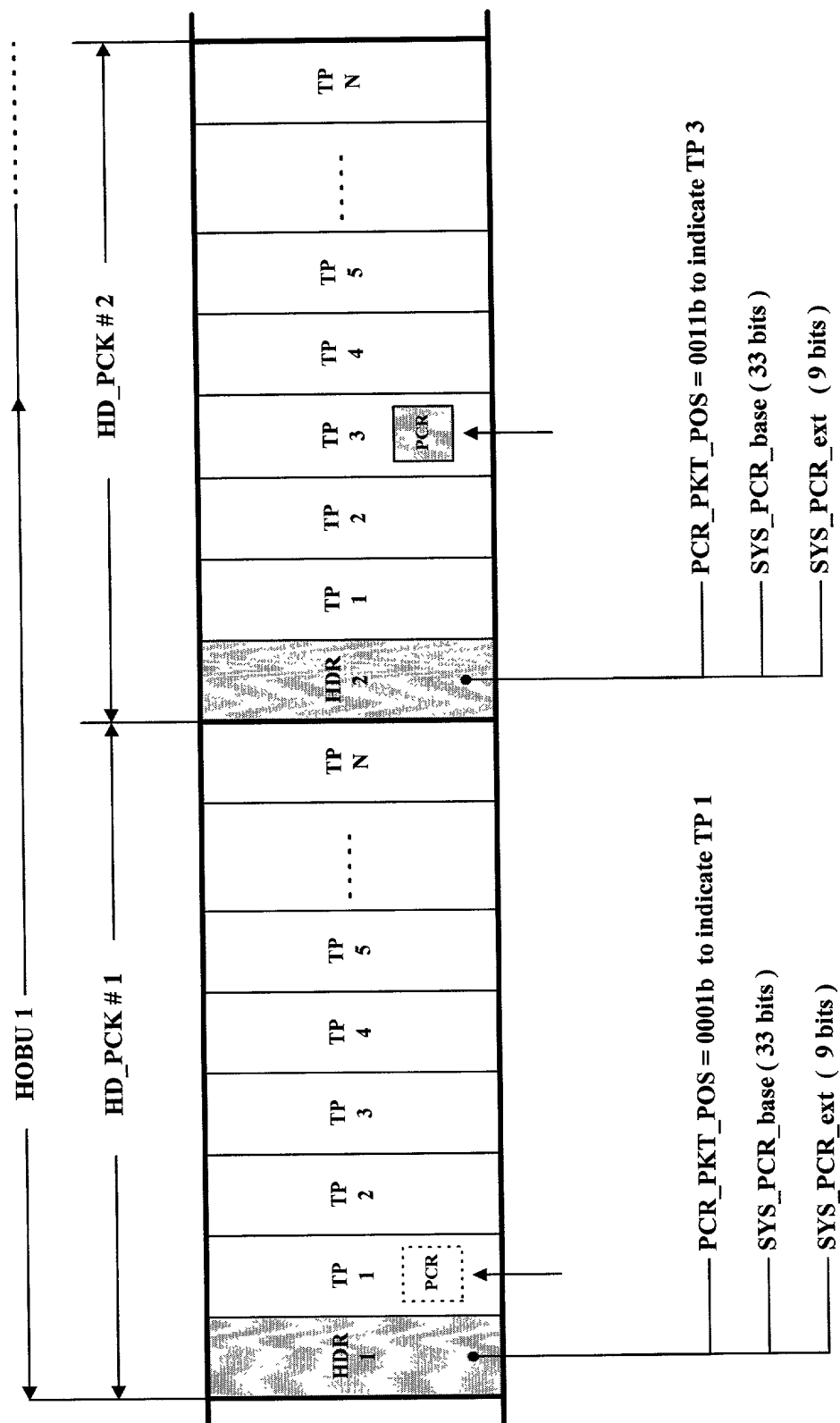
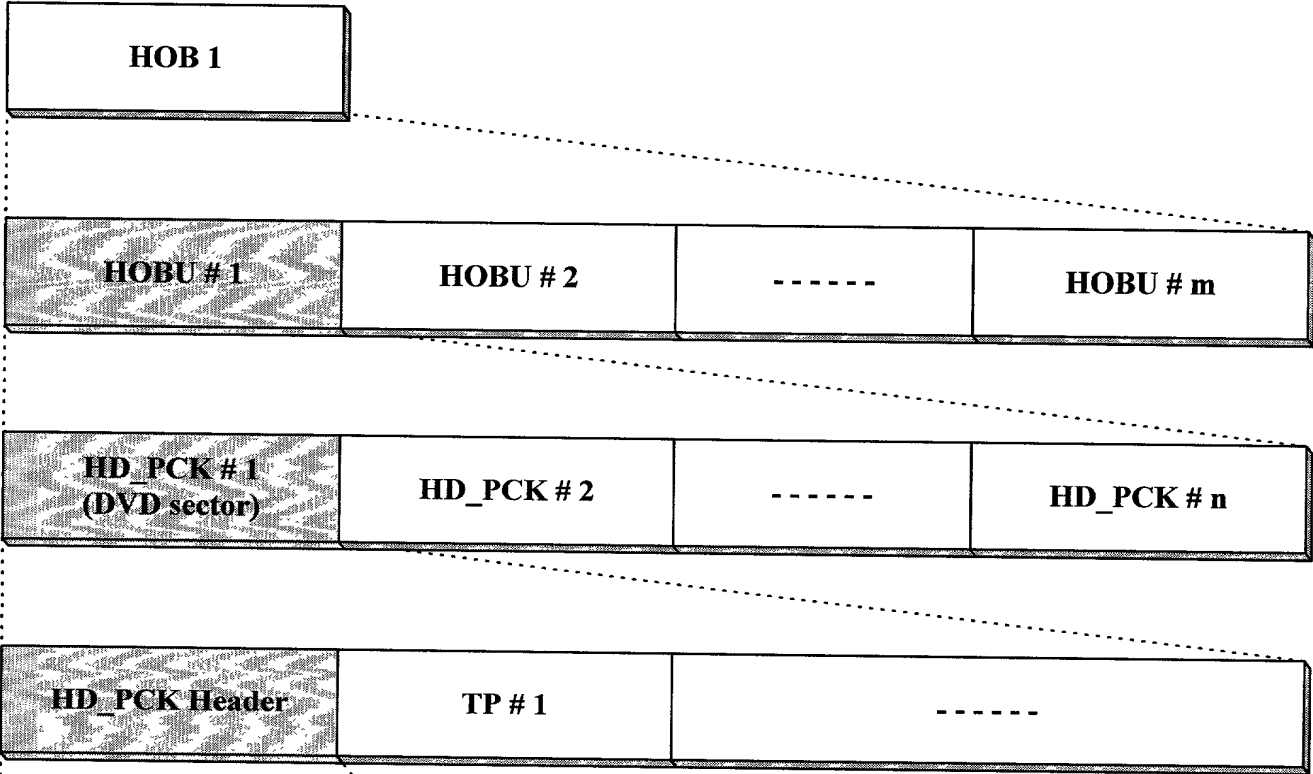


FIG. 9



Field	bits
PCR_PKT_POS	4
RSV	2
TRICK_S_POS	4
TRICK_E_POS	4
F_PKT_offset	8
Valid_PKT_Nu	8

20040418012036360

FIG. 10

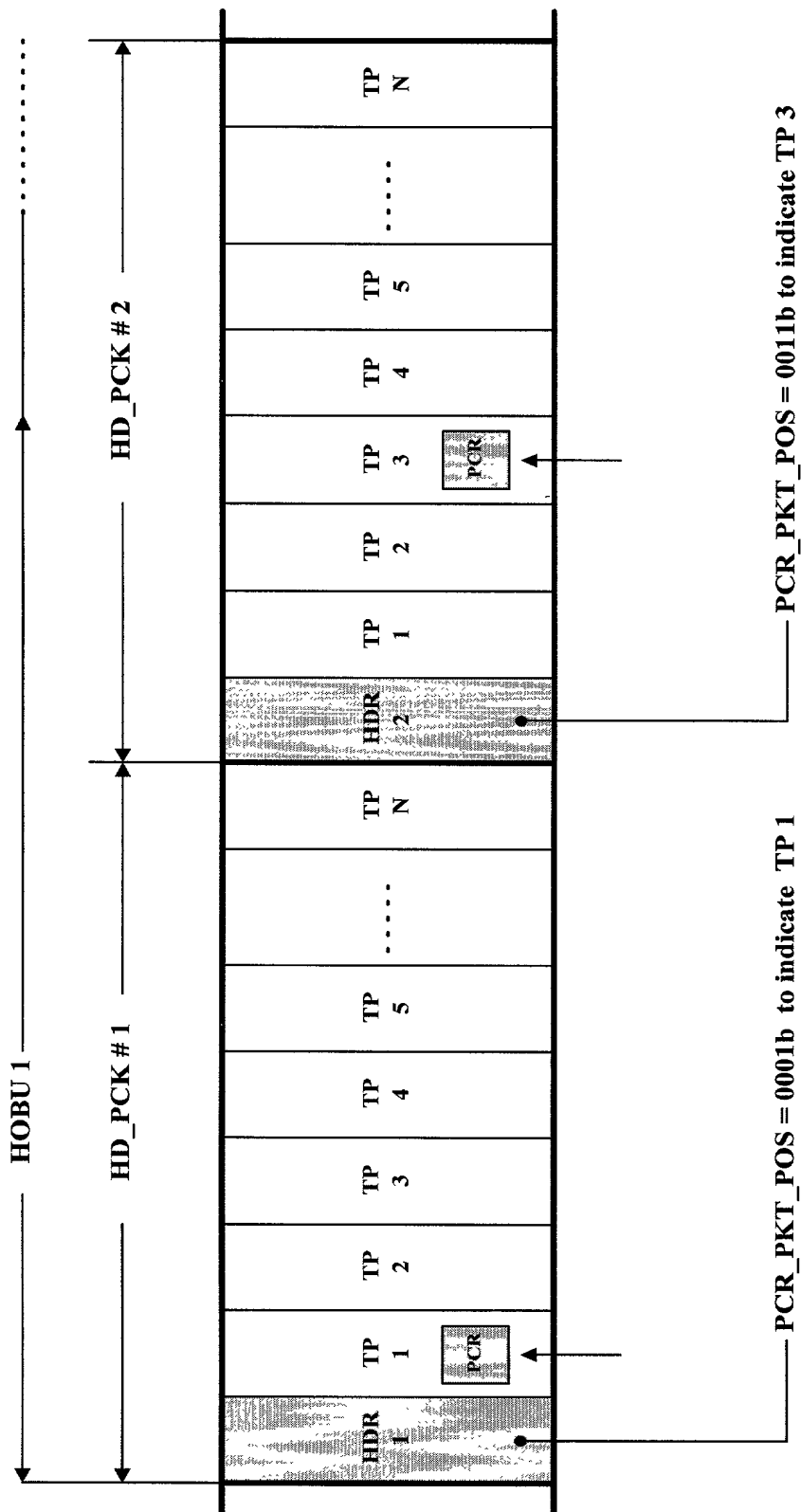


FIG. 11

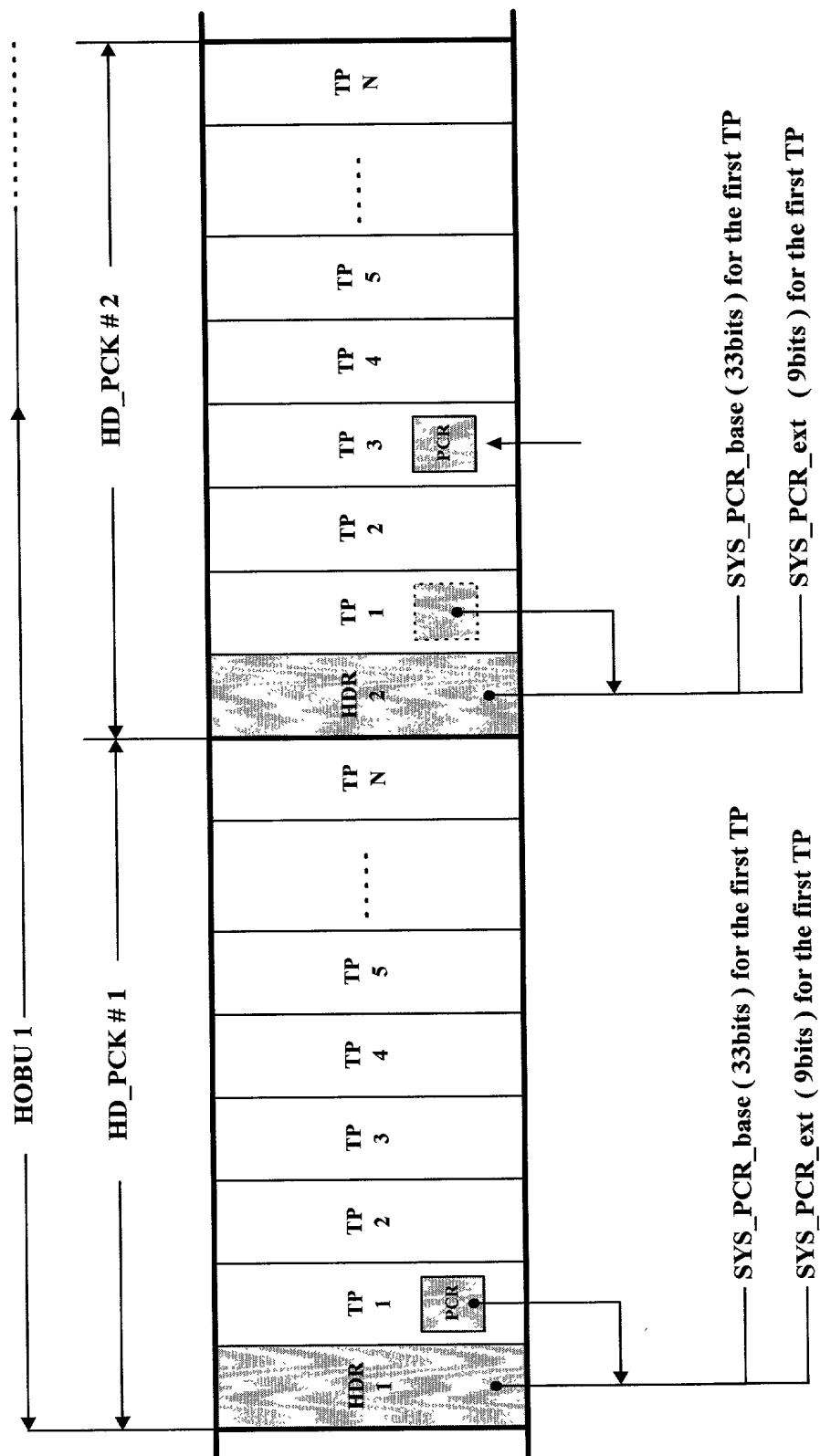
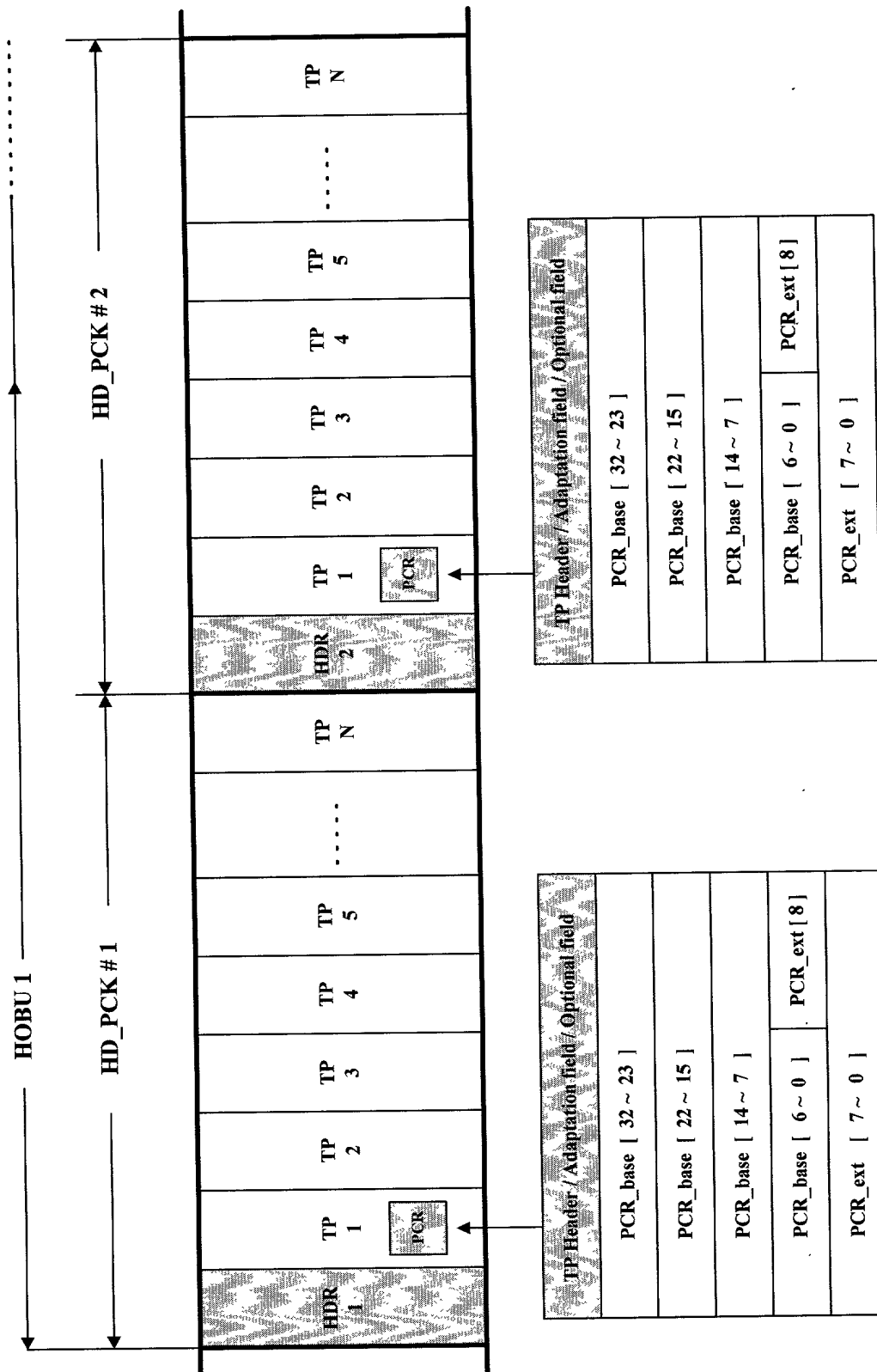


FIG. 12



PLEASE NOTE
YOU MUST
COMPLETE THE
FOLLOWING

COMBINED DECLARATION AND POWER OF ATTORNEY
FOR PATENT AND DESIGN APPLICATIONS

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated next to my name, that I verily believe that I am the original, first and sole inventor (if only one inventor is named below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled.

Insert Title
Fill in Appropriate
Information
For Use Without
Specification
Attached.

METHOD FOR CREATING AND RECORDING TRANSPORT TIME INFORMATION
FOR DATA RECORDED ON A DISK RECORDING MEDIUM

the specification of which is attached hereto. If not attached hereto

the specification was filed on _____ as
United States Application Number _____;
and amended on _____ (if applicable) and/or
the specification was filed on _____ as PCT
International Application Number _____; and was
amended under PCT Article 19 on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I do not know and do not believe the same was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representative or assigns more than twelve months (six months for designs) prior to this application, and that no application for patent or inventor's certificate on this invention has been filed in any country foreign to the United States of America prior to this application by me or my legal representatives or assigns, except as follows:

I hereby claim foreign priority benefits under Title 35, United States Code §119(a) (d) of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)

Priority Claimed

Insert Priority
Information.
(If appropriate)

<u>99-33203</u> (Number)	<u>Korea</u> (Country)	<u>08/12/1999</u> (Month/Day/Year Filed)	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
<u>99-33204</u> (Number)	<u>Korea</u> (Country)	<u>08/12/1999</u> (Month/Day/Year Filed)	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
_____ (Number)	_____ (Country)	_____ (Month/Day/Year Filed)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
_____ (Number)	_____ (Country)	_____ (Month/Day/Year Filed)	<input type="checkbox"/> Yes	<input type="checkbox"/> No

I hereby claim the benefit under Title 35, United States Code, §119(e) of any United States provisional application(s) listed below

Insert Provisional
Application(s).
(If any)

_____ (Application Number)	_____ (Filing Date)
_____ (Application Number)	_____ (Filing Date)

All Foreign Applications, if any, for any Patent or Inventor's Certificate Filed More than 12 Months (6 Months for Designs) Prior to the Filing Date of This Application

Insert Requested
Information
(If appropriate)

Country	Application Number	Date of Filing (Month/Day/Year)
_____	_____	_____
_____	_____	_____

I hereby claim the benefit under Title 35, United States Code, §120 of any United States and/or PCT application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States and/or PCT application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to the patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

Insert Prior U.S.
Application(s)
(If any)

_____ (Application Number)	_____ (Filing Date)	_____ (Status: patented pending abandoned)
_____ (Application Number)	_____ (Filing Date)	_____ (Status: patented pending abandoned)

Insert (if)

I hereby appoint the following attorneys to prosecute this application and/or an international application based on this application and to transact all business in the Patent and Trademark Office connected therewith and in connection with the resulting patent based on instructions received from the entity who first sent the application papers to the attorneys identified below, unless the inventor(s) or assignee provides said attorneys with a written notice to the contrary.

Raymond C. Stewart	(Reg. No. 21,066)	Terrell C. Birch	(Reg. No. 19,352)
Joseph A. Kolasch	(Reg. No. 22,463)	James M. Slattery	(Reg. No. 25,350)
Bernard L. Sweeney	(Reg. No. 24,448)	Michael K. Munter	(Reg. No. 29,680)
Charles Corenstein	(Reg. No. 29,271)	Gerald M. Murphy, Jr.	(Reg. No. 28,977)
Leonard R. Svensson	(Reg. No. 30,330)	Terry L. Clark	(Reg. No. 32,644)
Andrew D. Meikle	(Reg. No. 32,868)	Marc S. Weiner	(Reg. No. 32,181)
Joe McKinney Muncy	(Reg. No. 32,334)	Donald J. Daley	(Reg. No. 31,313)
John W. Balley	(Reg. No. 32,881)	John A. Castellano	(Reg. No. 35,094)
Gary D. Yacura	(Reg. No. 35,416)		

Send Correspondence to

BIRCH, STEWART, KOLASCH & BIRCH, LLP or Customer No. 2282
P.O. Box 747 • Falls Church, Virginia 22040-0747
Telephone: (703) 205-8000 • Facsimile: (703) 205-8050

PLEASE NOTE
YOU MUST
COMPLETE
THE
FOLLOWING:

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of First
or Sole Inventor
(Inventor Name of
Inventor)
Inventor Date This
Document is Signed

Inventor Address
(Inventor Address)

Inventor Post Office
Address

Full Name of Second
Inventor, if any

Full Name of Third
Inventor, if any

Full Name of Fourth
Inventor, if any

Full Name of Fifth
Inventor, if any

Page 2 of 4
Form P/T/20, 1/97

GIVEN NAME/FAMILY NAME Byung-Jin Kim	INVENTOR'S SIGNATURE <i>[Signature]</i>	DATE July 27, 2000
Residence (City, State & Country) Kyunggi-do, Korea		CITIZENSHIP Republic of Korea
POST OFFICE ADDRESS (Complete Street Address including City, State & Country) 111-204, Hansol Chunggu APT., 110, Jeongja-dong, Bundang-gu, Sungnam, Kyunggi-do, 463-010, Korea		
GIVEN NAME/FAMILY NAME Kang-hoo Goo	INVENTOR'S SIGNATURE <i>[Signature]</i>	DATE July 27, 2000
Residence (City, State & Country) Kyunggi-do, Korea		CITIZENSHIP Republic of Korea
POST OFFICE ADDRESS (Complete Street Address including City, State & Country) 606-503, Chewon Hanyang APT., 897-5, Pyoungan-dong, Dongan-gu, Anyang, Kyunggi-do, 431-075, Korea		
GIVEN NAME/FAMILY NAME Jea-Yong Yoo	INVENTOR'S SIGNATURE <i>[Signature]</i>	DATE July 27, 2000
Residence (City, State & Country) Seoul, Korea		CITIZENSHIP Republic of Korea
POST OFFICE ADDRESS (Complete Street Address including City, State & Country) C-306, Maeboong Samsung APT., Dogok-dong, Kangnam-gu, Seoul, 135-270, Korea		
GIVEN NAME/FAMILY NAME KI-WON KANG	INVENTOR'S SIGNATURE <i>[Signature]</i>	DATE July 27, 2000
Residence (City, State & Country) Seoul, Korea		CITIZENSHIP Republic of Korea
POST OFFICE ADDRESS (Complete Street Address including City, State & Country) 1-305, Daero Villa, 15, Chungdam-dong, Kangnam-gu, Seoul, 135-100, Korea		
GIVEN NAME/FAMILY NAME	INVENTOR'S SIGNATURE	DATE
Residence (City, State & Country)	CITIZENSHIP	
POST OFFICE ADDRESS (Complete Street Address including City, State & Country)		

DATE OF SIGNATURE